# SYNOPSIS
# DIELECTRIC STUDY OF ORGANIC COMPOUNDS AND ITS RELATED PROPERTIES AT MICROWAVE FREQUENCY

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## 1) ***INTRODUCTION***

Advanced microwave technique have accelerated remarkable development of measuring complex permittivity over a wide frequency range from 1MHz to 20 GHz by time domain reflectometry (TDR) technique. The Dielectric study provides valuable information about ordering of the molecular interactions in the binary mixture. The study of dilectric properties concerns storage and dissipation of electric and magnetic energy in materials. Dielectrics are important for explaining various phenomenon in electronics , optics, solid state physics and cell bio physics.

The organic compounds have medical, biological, and chemical importance. The Dielectric study of organic compounds is important for deciding their uses in different fields. The related behavior of compounds is also interesting for industries.

The other physical properties such as moisture content can be used for indirect sensing of such physical attributes of materials. They are also important because they affect the interaction of electromagnetic energy with the materials.

The electrical properties which determine the performance of liquid dielectrics are :

1) Ability to resist breakdown under electrical stress
2) The electrical capacitance per unit of volume determined by dielectric constant .
3) Loss factor- The energy loss per unit volume per cycle

These properties depend on the liquids operating temperature and frequency as well as on the structure of its constituent molecules

## 2) ***REVIEW OF LITERATURE AND DEVELOPMENT IN THE SUBJECT***

Dielectric and related properties of organic compounds has extensive applications in various fields. It helps for understanding molecular structure and its interaction with other molecules. Many researchers has studied the dielectric properties, physical properties thermodyanamic, ultrasonic properties of binary mixture of polar-polar, polar-nonpolar liquids. Dielectric relaxation study of solute- solvant mixture at microwave region gives information about molecular polarization in the system.

Dielectric study of pure liquid ,pulverized solid materials has a more scope in the medical , pharmacitical, biological and agricultural field for sensing the other important parameters.

## 3) ***OBJECTIVES OF RESEARCH / PROPOSED HYPOTHESIS***

We proposed to study dielectric and related properties of organic compounds at microwave frequency. We will study the dielectric parameters like dielectric parametrs like dielectric constant (Ɛ′) loss ( Ɛ"), loss tangent (Tan $\delta$), Relaxation time ($\tau$), Resistivity ($\rho$), viscosity, viscosit dipole moment and refractive index etc. We will study the acoustic parameters of organic compounds at MHz frequency

4) ***METHODOLOGY TO BE ADOPTED***

a) ***DIELECTRIC PARAMETERS.***

The Reflectometric technique is used for measuring reflection coefficient from the dielectric boundary of the sample at microwave frequency. The J/X microwave bench is to be used. The sample is introduced in the sample holding dielectric cell and plunger is moved slowly to change the liquid column in the dielectric cell the maxima and minima are to be noted from standing wave pattern. From this dielectric wavelength ($\lambda_d$) has to be calculated. From $\lambda_d$ measurement the various dielectric parameters are to be calculated by using following equations given in the literature.

$$\varepsilon' = \left(\frac{\lambda_0}{\lambda_c}\right)^2 + \left(\frac{\lambda_0}{\lambda_d}\right)^2 \qquad \text{------(1)}$$

$$\varepsilon'' = \frac{2}{\Pi}\left(\frac{\lambda_0}{\lambda_c}\right)^2 \frac{\lambda_g}{\lambda_d}\left(\frac{d\rho}{dn}\right) \qquad \text{------(2)}$$

$$\tau = \frac{\lambda_0}{2\Pi C}\left(\frac{dy}{dx}\right) \qquad \text{------(3)}$$

$$\mu^2 = \frac{9KTM}{4\Pi Nd}\left[1 + \left(\frac{dy}{dx}\right)^2\right]\frac{dX}{dW} \qquad \text{------(4)}$$

Where, $\varepsilon'$ is dielectric constant, $\varepsilon''$ is the dielectric loss, $\tau$ is relaxation time and $\mu$ is the dipole moment.

b) ***ACOUSTIC PARAMETER***

Using basic physical properties of liquid like ultrasonic velocity, density, viscosity and surface tension many other physical parameters can be obtained such as Adiabatic Compressibility (B), Intermolecular Free Length ($L_f$), Acoustic Impedance (Z), Relative Association ($R_A$)

$$\beta = -\frac{1}{v}\frac{dv}{dp} \qquad \text{------(5)}$$

$$L_f = K(\beta_{ad})^{1/2} \qquad \text{------(6)}$$

$$R_A = \frac{\delta_s}{\delta_0}\left(\frac{U_0}{U_s}\right)^{1/3} \qquad \text{------(7)}$$

$$Ultrasonic\ velocity\ (U) = Frequency(f) \times wavelength(\lambda) \qquad \text{------(8)}$$

5) ***IMPORTANCE OF STUDY / SOCIETY APPLICATION***

i) INTERNATIONAL STATUS:

In the present scenario many insecticides and pesticides are proving useless to kill harmful pests on the crops. Worldwide research has taken to produce or research an effective insecticides and pesticides.

As increasingly numbers of packaged food industries worldwide are in search of good flavoring agents which are safe for health. Therefore, the study will be helpful to the industry as useful information/ literature.

The synthesis of many drugs is carried out by pharmaceutical companies worldwide so during the synthesis the compounds containing polar liquids play an important role. Hence the present study can help to the Pharma sector also.

ii) NATIONAL STATUS:

The study of complex permittivity, relaxation of binary mixtures of polar liquids with non-polar liquids has been carried out in almost all Universities. The research work has carried out by using the instruments like TDR, FDR and impedance analyzer (four probe).

Many research paper has been published as related in molecule interaction study .

## 6) ***SIGNIFICANCE OF STUDY***

Dielectric relaxation of mixture gives meaningful information about molecular interaction system. The molecular structure and molecular interaction plays a vital role in the research and development of drugs, insecticides and pesticides, flavoring agent etc. The dielectric study polar liquids are important for understanding the hydrogen bonding and intermolecular interactions in the mixture. To exploit the benefit of such polar liquids the present work is undertaken.
After investigation of dielectric constant we can verify the purity of insecticides and pesticides and geometry of molecule. The study will be useful to verify the molecular interaction of newly synthesize.

## 7) ***PROPOSED WORKPLAN / FORMULATION AND STRUCTURE OF STUDY***

Year wise plan of work and target to be achieved.

**First year**

1. Collection of literature/ research paper.
2. Study of basic theory of dielectric and acoustic behavior of polar liquids.

**Second year**

1. Selection of properties of polar liquids purchasing chemicals of high grade.
2. Experimental training of J / X band and ultrasonic interferometer.
3. Observation / experimental work.
4. Calculation of dielectric and acoustic parameters.

**Third year**

1. Result and discussion on the data.
2. Presentation of research paper in conferences.
3. Publication of research work in referred journals.
4. Pre viva voce presentation.
5. Prewriting of thesis.
6. Final submission of thesis.

8) ***BIBLIOGRAPHY /REFERENCES***


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